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28 August 1981

Worldwide Report

NUCLEAR DEVELOPMENT AND PROLIFERATION

No. 111

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BEHIND-THE-SCENES CONTROVERSY IN TARAPUR TALKS NOTED

Madras THE HINDU in English 24 Jul 81 p 9

[Text]

A bizarre controversy, which has been raging behind the scenes for some time between India and the U.S. over alleged preparation for another nuclear test, is likely to explode into an open wrangle if the forthcoming talks on Tarapur break down.

The U.S. continues to maintain that, both in terms of its domestic legislation and international obligations, it is perfectly justified in insisting on tighter safeguards as a sine qua non for the continuance of the fuel supply agreement.

It claims to have irrefutable evidence, supported by satellite pictures, of Indian preparations for another test at Pokhran. But India has denied that any such activity was under way since no decision had been taken to carry out one more nuclear explosion.

Routine digging

The alleged drilling at the test site spotted by the U.S. spy satellites relates to some routine digging by the army which has been using this desert area for years as an artillery firing range. But the U.S. has not accepted this explanation in the absence of adequate proof that India is not planning or preparing for another test explosion.

At one stage the U.S. had held out the hope that the pending second shipment of enriched uranium cleared by the former President, Mr. Jimmy Carter, would be despatched if the present Administration was able to certify that there had been no material change in the Indian position.

The intention then was to ship the 19.6 tonnes covered by the clearance as part of a terminal arrangement to enable India to gain some time for running Tarapur with an alternative mixed-oxide fuel, if a satisfactory accord was reached for continuing the existing safeguards in a mutually acceptable form.

The U.S. negotiators have been arguing in private conversations that they are bound by the promise given to Congress by the former Secretary of State, Mr. Edmund Muskie, to bring

Tarapur or obtain the pending shipment as part of a terminal arrangement.

The new nuclear policy line of the Reagan Administration offers no easy way out that would be equally acceptable to India and the U.S.

Element of bluff

There is an element of bluff in the U.S. bid to brow-beat India and it would call for considerable skill in resisting the pressures without exposing itself to the accusation that it is indirectly encouraging proliferation in the name of asserting the country's sovereign rights.

The strategy of the Indian negotiators is to let the U.S. first violate the Tarapur accord both in its letter and spirit before winding up the existing safeguards on spent fuel and installations.

It will be open to India to continue these safeguards, in a modified form, if it so chooses, so long as their retention is not part of a terminal arrangement.

The point that is being stressed is that, irrespective of what the U.S. does in repudiating its obligations, there will be no change in India's commitment to the cause of non-proliferation. The Government will, however, continue to exercise its discretion in conducting further tests, if necessary, for harnessing nuclear energy for peaceful purposes undeterred by international pressures.

It was officially announced today that a U.S. delegation led by the Assistant Secretary of State, Mr. James Malone, would be arriving in Delhi for talks on the Tarapur agreement.

to its notice any material change in the Indian position before despatching the pending shipment in due course.

They want a firm indication from India that it would not engage in another test before they can give the assurance to Congress in terms of Mr. Muskie's commitment.

Basic dispute

Though India has no intention of carrying out a new nuclear test in the near future, it sees no reason why it should hold out any such one-sided guarantee to a country that was bent on unilaterally repudiating a contractual obligation.

It wants the U.S. to continue to abide by the fuel supply agreement on the basis of the existing safeguards without imposing fresh conditions.

But this astonishing controversy over India's alleged intention to have another test is only an off-shoot of a more basic dispute over the continued validity of the fuel supply agreement.

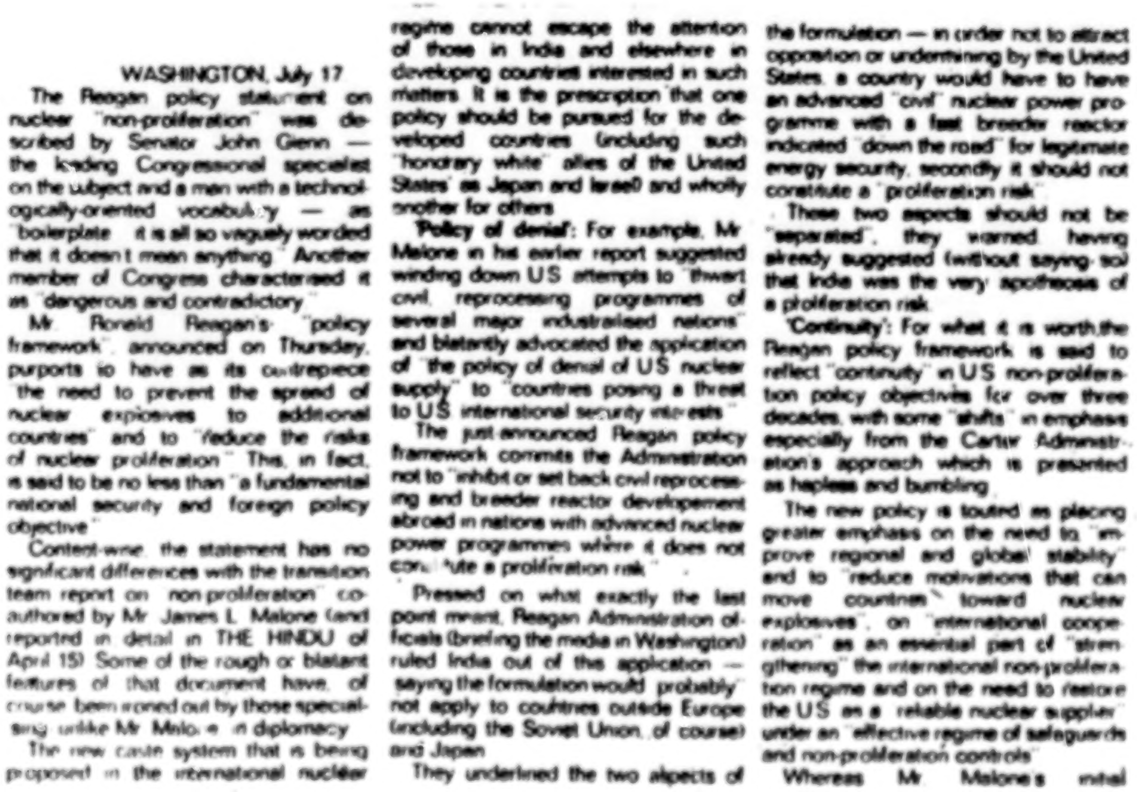
At the forthcoming talks the main focus will be on the U.S. attempt to tighten the safeguards and India's refusal to comply with it.

It is highly unlikely that India would compromise its stand against any discriminatory safeguards either to secure an uninterrupted supply of fuel for

DOUBLE STANDARDS IN U.S. NUCLEAR AID POLICY ALLEGED

Madras THE HINDU in English 18 Jul 81 p 9

[Text]



WASHINGTON, July 17

The Reagan policy statement on nuclear "non-proliferation" was described by Senator John Glenn — the leading Congressional specialist on the subject and a man with a technologically-oriented vocabulary — as "boilerplate it is all so vaguely worded that it doesn't mean anything." Another member of Congress characterised it as "dangerous and contradictory."

Mr. Ronald Reagan's "policy framework", announced on Thursday, purports to have as its centrepiece "the need to prevent the spread of nuclear explosives to additional countries" and to "reduce the risks of nuclear proliferation." This, in fact, is said to be no less than "a fundamental national security and foreign policy objective."

Content-wise, the statement has no significant differences with the transition team report on "non-proliferation" co-authored by Mr James L. Malone (and reported in detail in THE HINDU of April 15). Some of the rough or blatant features of that document have, of course been ironed out by those specialising unlike Mr Malone in diplomacy.

The new caste system that is being proposed in the international nuclear regime cannot escape the attention of those in India and elsewhere in developing countries interested in such matters. It is the prescription that one policy should be pursued for the developed countries (including such "honorary white" allies of the United States as Japan and Israel) and wholly another for others.

'Policy of denial': For example, Mr Malone in his earlier report suggested winding down US attempts to "thwart civil reprocessing programmes of several major industrialised nations" and blatantly advocated the application of "the policy of denial of US nuclear supply" to "countries posing a threat to US international security interests."

The just-announced Reagan policy framework commits the Administration not to "inhibit or set back civil reprocessing and breeder reactor development abroad in nations with advanced nuclear power programmes where it does not constitute a proliferation risk."

Pressed on what exactly the last point meant, Reagan Administration officials (briefing the media in Washington) ruled India out of this application — saying the formulation would "probably" not apply to countries outside Europe (including the Soviet Union, of course) and Japan.

They underlined the two aspects of the formulation — in order not to attract opposition or undermining by the United States, a country would have to have an advanced "civil" nuclear power programme with a fast breeder reactor indicated "down the road" for legitimate energy security, secondly it should not constitute a "proliferation risk."

These two aspects should not be "separated", they warned having already suggested (without saying so) that India was the very apotheosis of a proliferation risk.

'Continuity': For what it is worth, the Reagan policy framework is said to reflect "continuity" in US non-proliferation policy objectives for over three decades, with some "shifts" in emphasis especially from the Carter Administration's approach which is presented as hapless and bumbling.

The new policy is touted as placing greater emphasis on the need to "improve regional and global stability" and to "reduce motivations that can move countries toward nuclear explosives", on "international cooperation" as an essential part of "strengthening" the international non-proliferation regime and on the need to restore the US as a "reliable nuclear supplier" under an "effective regime of safeguards and non-proliferation controls."

Whereas Mr. Malone's initial

handiwork proposed eight "criteria" as the basis of Reagan Administration policy, the policy statement has seven "guidelines".

Security objective: First, the United States will "seek to prevent the spread of nuclear explosives to additional countries as a fundamental national security and foreign policy objective".

Secondly, it will "strive to reduce the motivation for acquiring nuclear explosives by working to improve regional and global stability and to promote understanding of the legitimate security concerns of other States".

(This appears mainly to be a reference to Pakistan and India, with the logic being that the interests not merely of regional stability but also of "non-proliferation" demand the rearming of the Pakistani military dictatorship on a significant scale).

Thirdly, the United States will "continue to support adherence" to the treaty on the non-proliferation of nuclear weapons and to the Tlatelolco treaty applicable to Latin America by countries that have not accepted these treaties.

Directed at India: Fourthly, it will "view a material violation of these treaties or an international safeguards agreement as having profound consequences for international order and United States bilateral relations, and also view any nuclear explosion by a non-nuclear-weapon State with grave concern". (The edge of this intimidatory guideline also seems to be directed at India).

Fifthly, it will "strongly support and continue to work with other nations to strengthen the International Atomic Energy Agency to provide for an improved international safeguards regime".

Sixthly, the United States will "seek to work more effectively with other countries to forge agreement on measures for combating the risks of proliferation".

Finally it will "continue to inhibit the transfer of sensitive nuclear material, equipment and technology, particularly where the danger of proliferation demands, and to seek agreement on requiring IAEA safeguards on all nuclear activities in a non-nuclear-weapon State as a condition for any significant new nuclear supply commitment".

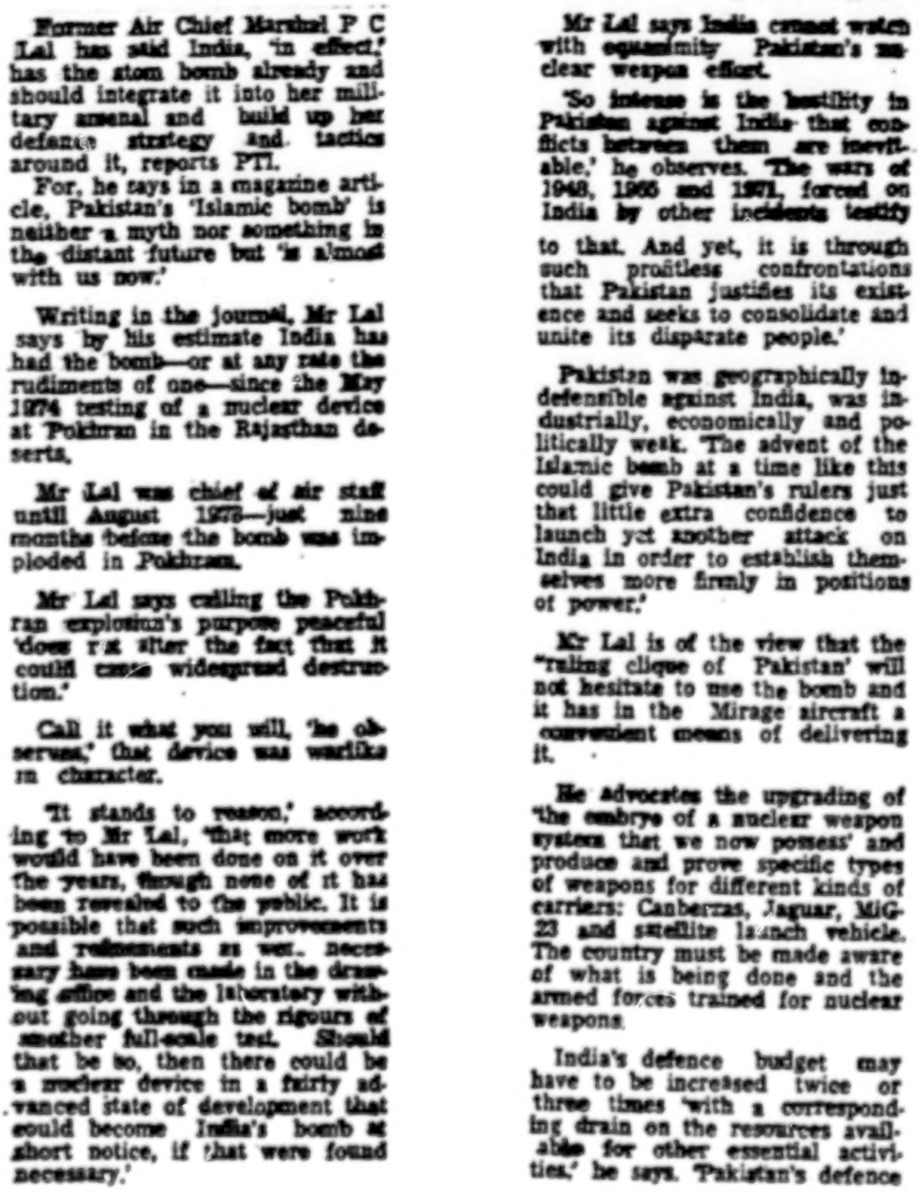
India will particularly appreciate the irony of Mr Reagan setting forth in his statement of July 16 the need to "re-establish this nation as a predictable and reliable partner for peaceful nuclear cooperation under adequate safeguards" — on the eve of Mr Malone's visit to India to formalise the liquidation of the Tarapur arrangement.

INDIA

FORMER OFFICIALS, DEFENSE EXPERT ADVOCATE NUCLEAR ARSENAL

New Delhi PATRIOT in English 18 Jul 81 p 5

[Text]



Former Air Chief Marshal P C Lal has said India, 'in effect,' has the atom bomb already and should integrate it into her military arsenal and build up her defence strategy and tactics around it, reports PTI.

For, he says in a magazine article, Pakistan's 'Islamic bomb' is neither a myth nor something in the distant future but 'is almost with us now.'

Writing in the journal, Mr Lal says by his estimate India has had the bomb—or at any rate the rudiments of one—since the May 1974 testing of a nuclear device at Pokhran in the Rajasthan deserts.

Mr Lal was chief of air staff until August 1973—just nine months before the bomb was imploded in Pokhran.

Mr Lal says calling the Pokhran explosion's purpose peaceful 'does not alter the fact that it could cause widespread destruction.'

Call it what you will, 'he observes,' that device was warlike in character.

'It stands to reason,' according to Mr Lal, 'that more work would have been done on it over the years, though none of it has been revealed to the public. It is possible that such improvements and refinements as were necessary have been made in the drawing office and the laboratory without going through the rigours of another full-scale test. Should that be so, then there could be a nuclear device in a fairly advanced state of development that could become India's bomb at short notice, if that were found necessary.'

Mr Lal says India cannot watch with equanimity Pakistan's nuclear weapon effort.

'So intense is the hostility in Pakistan against India that conflicts between them are inevitable,' he observes. 'The wars of 1948, 1965 and 1971, forced on India by other incidents testify to that. And yet, it is through such profitless confrontations that Pakistan justifies its existence and seeks to consolidate and unite its disparate people.'

Pakistan was geographically indefensible against India, was industrially, economically and politically weak. 'The advent of the Islamic bomb at a time like this could give Pakistan's rulers just that little extra confidence to launch yet another attack on India in order to establish themselves more firmly in positions of power.'

Mr Lal is of the view that the "ruling clique of Pakistan' will not hesitate to use the bomb and it has in the Mirage aircraft a convenient means of delivering it.

He advocates the upgrading of 'the embryo of a nuclear weapon system that we now possess' and produce and prove specific types of weapons for different kinds of carriers: Canberras, Jaguar, MiG-23 and satellite launch vehicle. The country must be made aware of what is being done and the armed forces trained for nuclear weapons.

India's defence budget may have to be increased twice or three times 'with a corresponding drain on the resources available for other essential activities,' he says. 'Pakistan's defence expenditure would soar in like fashion with even more drastic effects on its flimsy economy and political structure.'

KAUL'S VIEW

Former Foreign Secretary T N Kaul in another article in the same journal issue, says India did not go nuclear after the explosion of the first Chinese bomb in 1964 because of the death of Dr Homi Bhabha, the preoccupation of Dr Vikram Sarabhai with space research and satellites, and the opposition of Prime Minister Lal Bahadur Shastri to nuclear explosions.

Nothing positive was done to avert the nuclear threat from China by developing a deterrent nuclear capability of our own, Mr Kaul says.

Mrs Indira Gandhi launched a dynamic programme for research in peaceful nuclear explosions, but Mr Morarji Desai was against explosion of nuclear devices even for peaceful purposes. When she became Prime Minister again in 1980, Mrs Gandhi reverted to the policy of keeping India's option open.

After the series of Chinese explosions and the imminence of one by Pakistan, there could be no two opinions about the need of India to have a deterrent nuclear capability, Mr Kaul asserts.

Director of the Institute for Defence Studies and Analyses K. Subrahmanyam says India really has no choice.

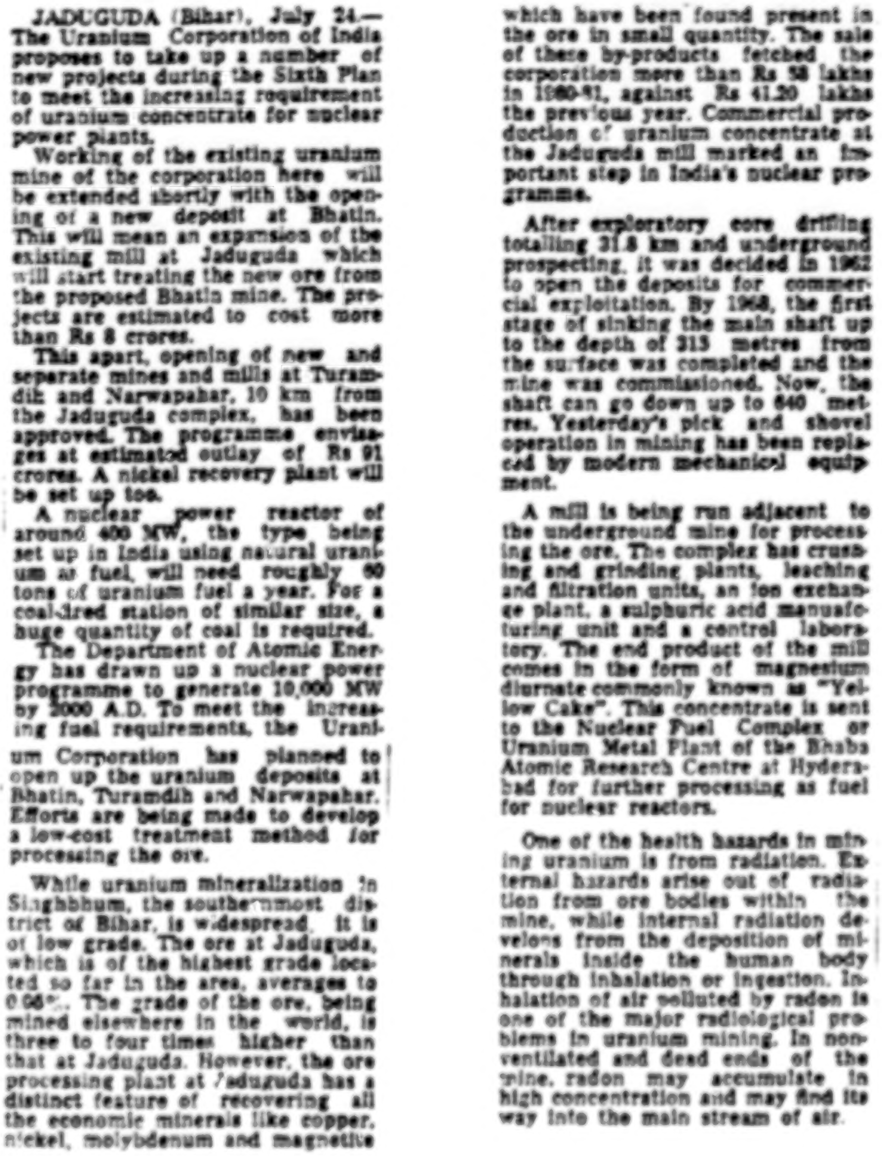
It is his opinion that India has to keep a few steps ahead of Pakistan in nuclear weapon technology and develop the infrastructure to be in a position to deter Pakistan when it reaches nuclear capability.

The only alternative was either to rely on external guarantees and sign away independence or to let the enemy overrun the country.

URANIUM CORPORATION OF INDIA PLANS NEW PROJECTS

Calcutta THE STATESMAN in English 25 Jul 81 p 7

[Text]



JADUGUDA (Bihar), July 24—The Uranium Corporation of India proposes to take up a number of new projects during the Sixth Plan to meet the increasing requirement of uranium concentrate for nuclear power plants.

Working of the existing uranium mine of the corporation here will be extended shortly with the opening of a new deposit at Bhatin. This will mean an expansion of the existing mill at Jaduguda which will start treating the new ore from the proposed Bhatin mine. The projects are estimated to cost more than Rs 8 crores.

This apart, opening of new and separate mines and mills at Turamdih and Narwapahar, 10 km from the Jaduguda complex, has been approved. The programme envisages at estimated outlay of Rs 91 crores. A nickel recovery plant will be set up too.

A nuclear power reactor of around 400 MW, the type being set up in India using natural uranium as fuel, will need roughly 60 tons of uranium fuel a year. For a coal-fired station of similar size, a huge quantity of coal is required.

The Department of Atomic Energy has drawn up a nuclear power programme to generate 10,000 MW by 2000 A.D. To meet the increasing fuel requirements, the Uranium Corporation has planned to open up the uranium deposits at Bhatin, Turamdih and Narwapahar. Efforts are being made to develop a low-cost treatment method for processing the ore.

While uranium mineralization in Singhbhum, the southernmost district of Bihar, is widespread, it is of low grade. The ore at Jaduguda, which is of the highest grade located so far in the area, averages to 0·06%. The grade of the ore, being mined elsewhere in the world, is three to four times higher than that at Jaduguda. However, the ore processing plant at Jaduguda has a distinct feature of recovering all the economic minerals like copper, nickel, molybdenum and magnetite which have been found present in the ore in small quantity. The sale of these by-products fetched the corporation more than Rs 58 lakhs in 1980-81, against Rs 41.20 lakhs the previous year. Commercial production of uranium concentrate at the Jaduguda mill marked an important step in India's nuclear programme.

After exploratory core drilling totalling 31.8 km and underground prospecting, it was decided in 1962 to open the deposits for commercial exploitation. By 1968, the first stage of sinking the main shaft up to the depth of 313 metres from the surface was completed and the mine was commissioned. Now, the shaft can go down up to 640 metres. Yesterday's pick and shovel operation in mining has been replaced by modern mechanical equipment.

A mill is being run adjacent to the underground mine for processing the ore. The complex has crushing and grinding plants, leaching and filtration units, an ion exchange plant, a sulphuric acid manufacturing unit and a control laboratory. The end product of the mill comes in the form of magnesium diurnate commonly known as "Yellow Cake". This concentrate is sent to the Nuclear Fuel Complex or Uranium Metal Plant of the Bhaba Atomic Research Centre at Hyderabad for further processing as fuel for nuclear reactors.

One of the health hazards in mining uranium is from radiation. External hazards arise out of radiation from ore bodies within the mine, while internal radiation develops from the deposition of minerals inside the human body through inhalation or ingestion. Inhalation of air polluted by radon is one of the major radiological problems in uranium mining. In non-ventilated and dead ends of the mine, radon may accumulate in high concentration and may find its way into the main stream of air.

BRIEFS

URANIUM IN MADHYA PRADESH--Calcutta, July 22 (UDI): Scientists of the Atomic Mineral Division (AMD) have struck uranium at the little known Darba area in Bastar district of Madhya Pradesh. This adds one more area to the country's atomic mineral map. The discovery of the mineral, needed for the nuclear power programme, at Dara has been described as "significant" by official sources here. The Department of Atomic Energy had undertaken drilling in Darba to assess the centralization of uranium, the sources added. [Text] [Bombay THE TIMES OF INDIA in English 23 Jul 81 p 5]

CSO: 5100

URANIUM SEAWATER EXTRACTION DEVELOPED

OW050557 Tokyo KYODO in English 0531 GMT 5 Aug 81

[Text] Tokyo, 5 Aug (KYODO)--Japan is developing a method of extracting uranium from the sea which scientists claim will be price-competitive with every other known form of energy resource.

A government test plant to extract uranium 233 and 235 from the Japanese Inland Sea, near the town of Nio on the Island of Shikoku, went into operation last month on a limited scale pending completion of construction.

Although on an extremely small scale so far, the operators, the governmental Metal Mining Agency, say the results so far indicate a Japanese-developed absorbent being used experimentally is far superior to anything now in operation in other countries.

Countries like Britain, France, West Germany and the United States have all been pursuing the goal of obtaining the virtually inexhaustible particles of uranium in sea water to compensate for the dwindling land-based supplies of the vital material for atomic energy.

Until now, West Germany has been regarded as being the front runner, with a pilot plant already in full operation. But researchers from governmental, academic and industrial laboratories collaborating on the Nio test plant now believe that Japan has some justification for claiming to be in the lead.

They are basing this claim on the fact that the Japanese method absorbs uranium 20 times more effectively than conventional equivalents already in existence.

The absorbent is a common sort of acrylic fiber combined with an amidoxime (amide being a class of crystalline compounds derived from ammonia) treated with alkali.

The governmental Industrial Research Institute, which headed the development team, says the material picked up 4 milligrams of uranium per 1 gram of absorbent after 10 days continuous immersion in the sea.

The institute says the best known conventional absorbent, using titanium oxide, gathered only 0.2 milligrams per 1 gram under equal conditions.

Hidetoshi Miyazaki, the institute's chief chemist, said extraction almost certainly could be boosted considerably if the absorbent was processed into netting or fabric form to increase the area of contact with the water.

Japan is giving the project top priority. It has no land-based uranium resources and it is totally dependent on imports. Government and industry are now cooperating in uranium exploration projects with several countries, primarily in West Africa.

Many experts, however, believe the world's land uranium resources could be exhausted by the end of the century in view of the growing pace of mining to meet the world's rapidly expanding need for nuclear energy as an alternative to oil.

By contrast, the uranium resources of the sea are roughtly estimated at about 4 billion tons. If all goes well with the current Nio model plant, the Metal Mining Agency hopes to see Japan's first practical uranium seawater extraction project underway by early 1990. The model plant itself will be in full operation by 1984.

Japanese research has been underway for the past 20 years. It has taken this long to reach the test extraction stage because of the many technical difficulties involved.

Although there is plenty of uranium in the sea it is obviously dispersed over a wide area and therefore is in only minute quantities at any one spot. Any extraction facility, therefore, must be on a large scale so as to be able to process the vast amounts of seawater needed.

To obtain only 3 grams of uranium, for example, at least 1,000 tons of water is required. The Nio plant is on a modest scale and will only be able to produce about 10 kilograms of uranium oxide a year. Even for this, some yen 2.4 billion ($9.6 million) is needed for construction.

One of the big questions about seawater uranium extraction has been whether it is really economically viable. A resounding "yes" comes from Professor Masayoshi Sugano, a nuclear energy engineer at the University of Tokyo and head of a government committee overseeing development of the necessary technology.

He reckons that reclaiming uranium from the sea can definitely be competitive with land uranium mining, coal, and even the prospective development of fast breeder reactor nuclear power plants that not only keep themselves going, but produce surplus fuel.

While the new Japanese absorbent is being further tested, the Nio plant will use the existing already-proven titanium oxide-based technology. Water will be pumped from the sea into a tank with a floor covered with a material containing titanium hydroxide.

According to Professor Sugano, such a plant, assuming annual uranium output of 1,000 tons, could produce uranium oxide at a cost of $334 a pound. This assumes a uranium reclamation rate of 50 percent. If the size of the pump could be increased, the professor believes that a rate of 60 percent would mean production costs of $223 per pound and for 80 percent only $161 a pound.

Refined uranium ore (yellow cake) available to Japan from land-based mines recently has been priced at between $32 to $43 a pound. So, seawater uranium would be five to 10 times more expensive. But experts say that would still be a low production cost and would be competitive with the currently rising cost of coal, now being used more and more as a quick substitute for oil.

Professor Sugano says American studies reckon that at $150 a pound seawater uranium would be competitive with coal or fast breeder reactor. But they have so far reckoned on at least $1,400 per pound with existing technology.

If the Japanese figures are right--and he certainly believes they are--the nuclear energy expert says there could be a "seawater uranium boom" by 1995.

CSO: 5100/2309

NEW URANIUM DEPOSITS NOT TOP QUALITY

SK050620 Seoul CHOSON ILBO in Korean 5 Aug 81 p 1

[Text] The ROK Ministry of Energy and Resources on 4 August denied that the uranium deposits found in Pochon and Cholwon areas are of top quality.

The ministry said it reached this conclusion after making inquiries on the matter at the meeting held at the ministry with those involved in the uranium exploration. Staff of the Energy and Resources Research Institute, the Mining Industry Development Corporation, the Mining Industry Registration Office and the Yongpung Company reportedly met with officials of the Ministry of Energy and Resources.

However, the Mining Industry Registration Office still maintains that a survey of the areas conducted for the registration of mining zones has confirmed that the uranium deposits found in the areas contain 0.2 to 3.6 percent uranium.

The establishment of a mining zone is authorized if a survey of the surface of the prospective mine area confirms uranium ore content of greater than 0.02 percent uranium. A precision survey on the size of deposits and quality is normally conducted following the establishment of mining zones.

At present, 24 mining zones have been registered in the Pochon and Cholwon areas by the Yongpung Company and others. The registration of 26 other mining zones in the same area is being processed.

Meanwhile, for the present, the Mining Industry Development Corporation reportedly has no plan for precision exploration and drilling in the areas.

CSO: 5100/2309

EDITORIAL VIEWS DECISION ON NEUTRON BOMB

PY121956 Sao Paulo O ESTADO DE SAO PAULO in Portuguese 11 Aug 81 p 3

[From "Notes and Information" page: "The Risks of a Decision"]

[Text] Ronald Reagan's decision to order the execution of the plan, partially abandoned by Carter in 1978, to manufacture the neutron bomb is evidence of the intensification of the superarms race beween the United States and the Soviet Union, and consequently of the worsening in the international situation. As can be remembered, nearly 3 years ago President Carter decided to temporarily suspend manufacture of the neutron bomb (dubbed "clean" wryly) and its subsequent positioning in European NATO bases. However, he made the length of the suspension conditional on the Soviet Union reaction. Carter deep down hoped that the Soviets would react to his "goodwill" gesture by reducing their conventional (Warsaw Pact tanks and aircrafts) and nuclear [SS-20 missiles targeted on the United States and medium range missiles aimed at strategic points in Western Europe) arsenals, thus relinquishing their superiority. Carter however maintained budgetary allocations for further development of the neutron bomb and missile-vehicles Lance and Sprint.

That typically Carter decision--typical in its hesitation--did not yield the expected reaction. The decision satisfied Soviet demands without receiving in return a similar goodwill gesture such as the slowdown in the superarms race and relinquishing the quest for military superiority (both conventional and nuclear)--a superiority which has become more obvious in the last 2 years. One can evaluate the seriousness of Reagan's decision in the light of such facts, a decision which reveals the U.S. determination to recover the strength seemingly lost through years of neglect and to secure a deterrent capability even at the cost of accelerating the arms race toward the absolute weapon. One can easily imagine that the Soviets--who responded to the U.S. moderation by intensifying their military preparedness--will not feel comfortable with Reagan's decision, more so when he speaks of recovering U.S. superiority although he would probably be content with real parity. One can easily predict that the Soviets will adopt measures not just to keep but to increase their edge in the production of weapons. Warnings to that effect are being heard more menacingly from Moscow.

The question is not the Soviet reaction, however, but the repercussions of Reagan's decision in European NATO circles, repercussions that are neither alike nor positive. The miliary imbalance which favored the Soviets in recent years increased Western Europe's fears of the Soviet threat. Fears have mounted to the point that, understandably but contradictorily, there are some who believe that the rearming of the West can precipitate a Soviet military reaction which will hit Europe first. This is why there are some who prefer the present situation although it means an increasing dependency on the Soviet Union. This way they can continue to live in a state of "Finlanditation." It is not difficult in this context to understand that the Reagan decision shifted to a critical point the relations not only with the Soviet Union but with the NATO countries as well.

The decision Carter adopted in 1978 caused profound disappointment and annoyance, especially in France and the FRG. France reacted proudly, in the spirit of Gen Charles de Gaulle's policy of grandeur. Giscard d'Estaing decided that his country would have the neutron bomb, and France has been manufacturing it since then. In 1978 the Germans felt greatly apprehensive about the prospects of their country being devastated by an aggression of the red army. They looked at the neutron bomb as a powerful tactical defensive weapon, capable of inflicting death but no destruction of buildings, machinery and vehicles; as a weapon capable of equalizing the 3-To1 tank and aircraft superiority of the Warsaw Pact. The Carter decision undermined FRG confidence in the guarantees and stability of U.S. diplomacy and, at that point, Bonn decided to reduce in its own way tensions with the Soviet bloc and to refrain from any measure which Moscow could consider provocative.

What the Germans fear most is the possibility of a double devastation; first by a Soviet offensive in the form of a blitzkrieg, and again by the U.S. liberating counteroffensive in a delayed and slow way. Incidentally, there are also Belgium's and the Netherland's reasons as well as those of increasingly pacifist groups in Italy and the FRG itself for refusing to accept the installation of U.S. Pershing and cruise missiles in their territory, although such missiles would be installed as a counterweight for the scores of medium range Soviet missiles which are already installed.

The risks implied in Reagan's decision are undeniably great. But the Soviets, who may also be wary of war, only understand the language of force. They certainly feel more respect for a strong adversary than for one who capitulates. From this perspective, Reagan's decision will likely lead to a clearcut understanding between the two superpowers.

CSO: 5100/2308

DAILY QUESTIONS HANDLING OF NEUTRON BOMB

PY131900 Rio de Janeiro JORNAL DO BRASIL in Portuguese 11 Aug 81 p 10

[Editorial: "Bomb and Politics"]

[Excerpts] The Reagan government's foreign policy has just made another unpredictable move, unpredictable and incomprehensible, by revealing the decision on the neutron bomb as a fait accompli.

Suddenly the neutron bomb is a fait accompli. This illustrates not only that the United States lacks or is late in working out a strategy not slanted to its confrontation with the Soviet Union, but also its indifference toward the rest of the world, including toward its natural allies. Worse yet, it serves to illustrate the lack of agreement within the U.S. Government itself as to what a more comprehensive strategy should be.

The question which became so obvious in Ottawa regarding economic matters is thus reinforced here in the diplomatic or strategic arena. The United States in Ottawa rejected any proposal to loosen its policy for the recovery of the dollar, even recognizing the negative effects of that policy on the world's economy. The United States sported an equally olympian attitude in the case of the neutron bomb. The reasons for such an attitude cannot be understood, considering that this bomb is tailor-made for the European theater. If the Europeans were against it before, they will be more so now that the bomb is imposed on them. What will become of NATO or other alliances if the Reagan Administration lapses into a nonchalance that is the antithesis of politics? Where does the Reagan government expect to find the allies it needs to carry out its singleminded tactic of confrontation with the Soviet Union?

CSO: 5100/2308

BRIEFS

FOREIGN MINISTER OPPOSES ARMS BUILDUP--Belo Horizonte (Brazil), 15 Aug (TELAM)--In the first official reaction to the U.S. decision to make the neutron bomb by the Brazilian Government, Foreign Minister Saraiva Guerreiro has said that he does not believe any form of useful, permanent cooperation can be based on threats of force. His statement was known here today upon publication of a speech he delivered last night at a seminar on foreign policy which is being held in this city, the capital of Minas Gerais state. "I do not believe excessive expenses on weapons with the pretext of seeking equilibrium will contribute to reducing tensions," Saraiva Guerreiro said. He added that Brazil does not accept the formation of blocs, axes, hegemonic principles, arms races, speculation over tensions and, in sum, everything that may result in the introduction into the continent of power plays and policies of dependence. [Text] [PY151856 Buenos Aires TELAM in Spanish 1520 GMT 15 Aug 81]

EDITORIAL SUPPORTS NEUTRON BOMB--At present the question of nuclear power seems to be reduced to some sort of accounting balance sheet between the United States and the Soviet Union. However, what should be of interest is the ratio of forces, so that the aggression capacity of the other side, and vice versa. Thus the U.S. neutron bomb is intended to offset the massive increase of Soviet military power, including the supposition that the neutron bomb is already part of the Soviet atomic arsenal. Reagan's strategy is based on the assumption that the Soviets could launch an attack on the European allies of the United States. In authorizing the manufacture of the neutron bomb, the U.S. intention is to dissuade the Soviets from launching that attack. Obviously the intention is not to attack the Soviet Union because, if it were so, the United States already has enough nuclear weapons. We are going through such a startling period of history that the only effective alternative to disarmament to ensure peace is the arms race which has been underway. It would be neither logical nor just to ask the leading power of Western democracy to deliberately condemn itself to lose that race. The cost of the race is exhorbitant and unjust, but there is no other alternative to defray its cost with resources more in keeping with the lofty spirit and destiny of the human race. [Excerpt] [PY150249 Rio de Janeiro O GLOBO in Portuguese 14 Aug 81 p 1]

NUCLEAR CONTRACT CANCEL ON ANGRA III--Rio de Janeiro--NUCON [Nuclebras Nuclear Plants Building Company] has canceled the contract with the Norberto Odebrecht Construction Company for the construction of the Angra III nuclear plant and decided to call for new bids, and to renegotiate the terms of the contract for Angra II, so as to force the company to maintain the timetable and the established prices. One of the measures adopted by NUCON to maintain the timetable and prices was changing the contracts with the Norberto Odebrecht Construction Company, which had been granted the construction of Angra II and Angra III, to those of the contract for the construction of Angra I, by decision of the then-Mines and Energy Minister Shigeaki Ueki. Thus, the revision of the terms of the contract with Norberto Odebrecht for Angra II seeks to concentrate the responsibilities of constructing companies exclusively on the civil construction of Angra II, adapting the terms of the contract to the obligations of respecting the timetable and prices agreed upon with NUCON. [Excerpts] [PY132338 Sao Paulo FOLHA DE SAO PAULO in Portuguese 1 Aug 81 p 14]

CSO: 5100/2309

MINOR PROBLEM REPORTED IN KOEBERG PLANT CONSTRUCTION

Cracks in Concrete

Johannesburg THE CITIZEN in English 15 Aug 81 p 4

[Text]

FINE cracks have appeared in the lower concrete raft supporting the Koeberg nuclear power plant at present under construction near Cape Town, the Minister of Mineral and Energy Affairs, Mr F W de Klerk said.

Replying to a question by Mr John Malcomess (PFP, Port Elizabeth Central), Mr De Klerk said such cracks were not unexpected in reinforced concrete structures of that size and the cracks were very small.

He said the cracks would not affect the operational safety of the plant.

Safety, Security Measures

Johannesburg THE CITIZEN in English 15 Aug 81 p 4

[Text]

THE Minister of Mineral and Energy Affairs, Mr F W de Klerk, yesterday gave an assurance that the planning of safety measures at the Koeberg power station was extremely effective, even when compared to the highest international standards.

He was asked during question time by Mr John Malcomess (PFP Port Elizabeth Central) whether the reactors at Koeberg would be able to withstand an attack designed to smash them by a hostile force.

"The risks attached to and consequences of hostile attacks on the Koeberg power station, together with measures to combat such attacks are matters which have been receiving careful attention since the planning stage of the Koeberg installation.

"These factors form an important part of the safety assessment conducted by the licensing branch of the Atomic Energy Board before a decision is made whether a licence should be granted for the operation of the plant and under what conditions such a licence should be issued.

"The assurance can be given that the planning of safety measures in respect of the Koeberg power station is "extremely effective, even when compared to the highest international standards.

"It would, however, not be in the national interest to disclosed the exact details of these security considerations," Mr De Klerk said.

CSO: 5100/4953

SELF-SUFFICIENCY IN ENRICHED URANIUM POSSIBLE IN NEXT FEW YEARS

Johannesburg THE STAR in English 24 Jul 81 p 20

[Article by David Bamber]

[Text]

South Africa will be able to produce sufficient enriched uranium to supply the entire needs of the Koeberg power station within the next few years, said Dr Ampie Roux, chairman of the Uranium Enrichment Corporation.

Addressing an Associated Scientific and Technical Societies' lecture in Johannesburg, Dr Roux said, it was sad that a respected country such as the United States was prepared to go back on its word as regards the supply of the fuel to this country.

But perhaps, due to the takeover by the Reagan administration, the decision was not final "I only hope they will honour this contract."

Dr Roux noted that the Uranium Enrichment Corporation had struck up a couple of partnerships in the development of the enrichment plant at Pelindaba. These had all been terminated on economic or political grounds, he said.

The first partner had been a German company but after three years of collaboration, it was not prepared to "share the risk" in the building of the plant so South Africa had decided to "go it alone."

A second partner from a country which Dr Roux declined to name pulled out immediately after the riots broke out in Soweto in June, 1976.

In answer to a question, Dr Roux said reasonable demand for enriched uranium throughout the world was about 48 000 tons a year.

Current supply was about 49 000 tons so there would not be much scope for expansion of the market until nuclear programmes which had been temporarily suspended were revived. — David Bamber.

CSO: 5100/4953

PROSPECTS FOR URANIUM MARKET DISCUSSED

Johannesburg RAND DAILY MAIL in English 5 Aug 81 p 18

[Article by John Mulcahy]

[Text]

IT is widely accepted that even a sudden energy crisis is unlikely to boost nuclear fuel prices.

The London Mining Journal says a further weakening of the uranium spot market could occur if the climate for nuclear power does not improve and the oversupply situation persists for a long time.

The Journal believes most South African producers can probably cope with this event, but some of the older, higher-cost producers, whose output is sold under old contracts, may come under pressure and fall by the wayside.

Most South Africa uranium plants are fairly modern with efficient facilities unlikely to become subject to severe cost pressures unless a further fall in the gold price renders some reefs unpayable.

Commercial stockpiles of uranium stand at about 100 000 tons of metal and are expected to rise to 110 000 tons by 1985 before starting to decline.

Uranium demand is still growing, but only at a marginal rate, with nuclear programmes revised in many countries in the aftermath of Three Mile Island (TMI).

The US has reassessed its nuclear power programme and a moratorium on licensing reactors is estimated to have set back the US nuclear industry by at least two years.

Africa accounts for about 40% of Western world production of uranium, with South West Africa and South Africa responsible for two-thirds of Africa's output.

South West Africa's only producer, Rossing Uranium, reached full production in 1979. Its uranium output has risen from nothing to 5 000 tons a year in a few years.

According to the Mining Journal, South Africa, more than any other producer, took advantage of the boom conditions of the 1970s, securing long-term contracts and investing heavily in new projects.

Within the past few years large plants have been commissioned by Ergo (200 tons uranium oxide a year), the Joint Metallurgical Scheme in the Free State — 850 tons a year, Southvaal — 750 tons a year, Randfontein — 600 tons a year, Chemwes — 600 tons a year, and Harmony.

All these projects brought about a rapid increase in output, which rose by 22% in 1979 and by a further 28% last year to 7 100 tons of uranium oxide.

A further increase is likely within the next two years as several other major projects come on stream, including Gencor's Beisa mine in the Free State, Rand Mines dump treatment project, and the Middle Elsburg uranium project at Western Areas.

The Journal believes these plans and projects are an indication that South Africa has the ability to produce uranium at a low cost.

"Even in the current (and forecast) climate of oversupply, Nufcor (which negotiates on behalf of all producers) is still able to secure contract terms that are acceptable and, in essence, this must signify that they can accept lower prices than producers in many other parts of the world."

Nufcor's success also reflects South Africa's reputation as a reliable long-term supplier of quality product.

It is estimated that nearly 90% of South Africa's known uranium resources occur within the gold-bearing conglomerates of the Witwatersrand Basin, and because most of the uranium is recovered as a by-product of gold mining, producers are generally far less sensitive to fluctuations in the uranium market than are many primary producers elsewhere.

Most of South Africa's uranium is sold on a long-term contractual basis, and the balance is periodically sold on the spot market.

As a result of by-production, lower spot prices can either be accepted by producers, or as most have substantial gold earnings to cushion the worst effects of fluctuating uranium prices, avoided.

In 1980 the record gold profits earned by most of the by-product uranium producers substantially exceeded uranium profits, and most producers were able to absorb the cost of stockpiling excess uranium instead of selling it at an unfavourable price.

However, in 1981 it has been less economical to stockpile because gold profits have in most cases tumbled.

Many producers have become unwilling to incur the cost of stockpiling and approaches have been made to the Government to fund a national stockpile of uranium when prices are unfavourable.

Several South African producers have been obliged to reconsider their uranium operations in the light of current price and market forecasts, and the emergence of a buyers' market has enabled many customers to put pressure on producers to modify contract terms.

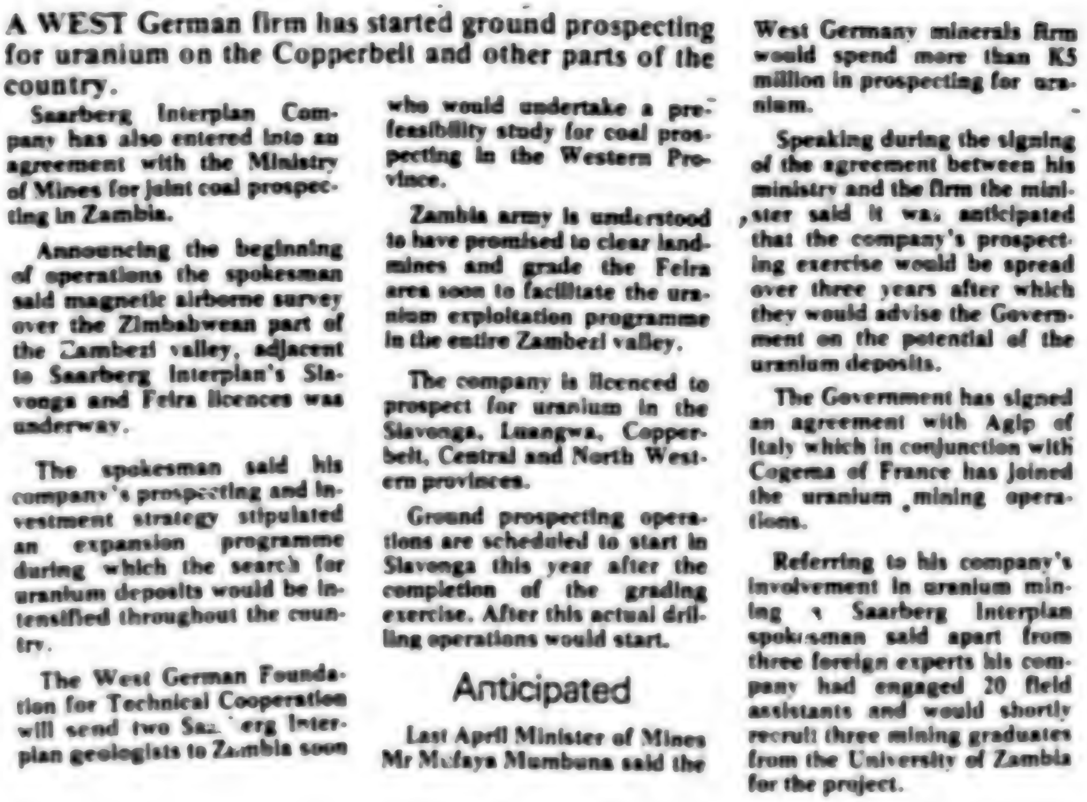
This has been a particular problem for primary producers, with no gold profits to cushion them from low uranium prices, and producers whose output is tied to older contracts at lower prices.

CSO: 5100/4953

WEST GERMAN FIRM TO START URANIUM PROSPECTING

Lusaka SUNDAY TIMES in English 9 Aug 81 p 7

[Text]



A WEST German firm has started ground prospecting for uranium on the Copperbelt and other parts of the country.

Saarberg Interplan Company has also entered into an agreement with the Ministry of Mines for joint coal prospecting in Zambia.

Announcing the beginning of operations the spokesman said magnetic airborne survey over the Zimbabwean part of the Zambezi valley, adjacent to Saarberg Interplan's Siavonga and Feira licences was underway.

The spokesman said his company's prospecting and investment strategy stipulated an expansion programme during which the search for uranium deposits would be intensified throughout the country.

The West German Foundation for Technical Cooperation will send two Saarberg Interplan geologists to Zambia soon who would undertake a pre-feasibility study for coal prospecting in the Western Province.

Zambia army is understood to have promised to clear landmines and grade the Feira area soon to facilitate the uranium exploitation programme in the entire Zambezi valley.

The company is licenced to prospect for uranium in the Siavonga, Luangwa, Copperbelt, Central and North Western provinces.

Ground prospecting operations are scheduled to start in Siavonga this year after the completion of the grading exercise. After this actual drilling operations would start.

Anticipated

Last April Minister of Mines Mr Mufaya Mumbuna said the West Germany minerals firm would spend more than K5 million in prospecting for uranium.

Speaking during the signing of the agreement between his ministry and the firm the minister said it was anticipated that the company's prospecting exercise would be spread over three years after which they would advise the Government on the potential of the uranium deposits.

The Government has signed an agreement with Agip of Italy which in conjunction with Cogema of France has joined the uranium mining operations.

Referring to his company's involvement in uranium mining a Saarberg Interplan spokesman said apart from three foreign experts his company had engaged 20 field assistants and would shortly recruit three mining graduates from the University of Zambia for the project.

CSO: 5100/4954

FRG, CANADA CONSIDER COMBINED NUCLEAR SALES TO THIRD WORLD

Bonn DIE WELT in German 20 Jul 81 p 3

[Article by Peter Gillies: "Joint Sales of Nuclear Technology--Schmidt and Trudeau Agree On Guidelines for Third World Exports"]

[Text] Ottawa--Canada and the FRG are planning a cooperative effort for selling nuclear technology to Third World countries. Federal Chancellor Helmut Schmidt and Canadian Prime Minister Pierre Elliot Trudeau agreed in Ottawa on a set of guidelines for this purpose. The country, which is exceptionally rich in raw materials, plans a major effort to attract German investors.

Schmidt and Trudeau met for a bilateral exchange of views just prior to the Seventh World Economic Summit Conference. Members of the German delegation indicated that the negotiations proceeded in an "excellent and unusually cordial" manner.

What Measures

This was particularly true of political consultations, while economic cooperation was not entirely without problems. Trudeau and Schmidt, personal friends and sailing enthusiasts both, tried to arrive at measures to be taken by their governments to make economic cooperation as frictionless as their political relations. The results of these talks was the agreement about joint activities in the area of nuclear technology. It was announced that Atomic Energy of Canada Ltd. would engage in joint ventures with the German Kraftwerk-Union (KWU) for the purpose of selling their nuclear technology to Third World and fringe countries.

As an example, Canadian Foreign Minister Mark MacGuigan cited the development of a "Power plant package" (Canadian reactor and German delivery system). The advantage of such cooperative projects, he said, lie in joint marketing as well as in combining Canadian technology and German experience in foreign trade.

The Federal chancellor emphasized the FRG's great interest in Canada's raw material resources, their exploitation and concomitant investments. He said that cooperation would be ideal because Canada is one of the world's major uranium producers. Schmidt made it clear to Trudeau that the FRG no longer has any objections in this matter, after earlier discord in that area.

Impromptu Deliberations

However, German government circles characterized the expansion of other areas of energy policy as "impromptu deliberations." This involved natural gas exploration (with subsequent liquefaction for transport), oil fields in the Canadian Arctic, and coal production. Schmidt thinks there are limits for coal imports to the FRG.

Both chiefs of government attempted to explore the complaints by German investors who feel discriminated against by Canadian laws. However, Premier Trudeau would not accept any blame for "economic nationalism." He stated that German investments in Canada had tripled during the last 3 years and that about 96 percent of all proposals from German firms were being approved.

Investor Failure

Schmidt is said to have countered this by stating that prominent investors (e.g. Wolff or Mannesmann) had failed due to exorbitant taxation. The reason for Canadian investment restrictions lies in the fear of foreign influence, especially with respect to U.S. enterprises. For instance, 90 percent of the Canadian automobile industry is in U.S. ownership. However, said Trudeau, German products have a good reputation and are therefore welcome. His country, he continued, is "greatly interested."

Among the severe Canadian conditions for foreign investors are delivery monopoly for the U.S. market as well as provisions for employment and research. The two chiefs of government suggested therefore that industrial delegations from both countries sit down together for the prupose of facilitating mutual investment.

9273
CSO: 5100/2296

FINANCIAL CONCERNS OVER CAIRO'S FRG NUCLEAR PLANT

Bonn DIE WELT in German 20 Jul 81 p 13

[Article by Heinz Heck: "Financing Is A Major Problem"]

[Text] Bonn--Even prior to this week's signing of the political declaration of intention on cooperation in the peaceful use of nuclear energy by the Egyptian and German foreign ministers, Kamal Hassan Ali and Hans-Dietrich Genscher, departmental conferences on further steps have started in Bonn. The principal subject is a supplementary agreement to the bilateral treaty on scientific and technological cooperation of 11 April 1977 between Egypt's Ministry of Electricity and Bonn's Ministry of Research.

Egypt plans to have a network of eight nuclear power plants with a capacity of 1,000 megawatts each by the year 2000; all of these are to be contracted for during the current year, if possible. Two units are presumably going to be furnished by each of the following countries: the United States, France and the FRG.

Nothing is known about the fourth country of manufacture to date. There is some speculation that it might be Canada. But this would mean that in addition to the light water reactors of the other three contractor countries the program would include natural uranium reactors which are the only type available from Canada. Political difficulties for the overall program no longer exist since the Egyptian government has decided to become a member of the nonproliferation treaty. Nor does Cairo have any interest in obtaining "sensitive" facilities, i.e. uranium enrichment and reprocessing of burned out fuel elements. Rather, the contractor countries are to assume responsibility for fuel supply. According to rumor, that is the subject of the agreements signed last March with France and last June with the United States.

In signing the nonproliferation treaty, Cairo has also eliminated the Egyptian-Israeli stalemate on this subject, which goes back over many years. In the past, all potential contracting countries observed the rule of thumb that nuclear power plants should for instance be delivered to Egypt only with equal consideration for Israel, and vice versa. However, Egypt's energy requirements can no longer stand further delay, which led President Anwar El-Sadat to sign the nonproliferation treaty, while Israel is still not prepared to do so.

From the point of view of the contractor countries, the main problem is the financing of the program. At the present time, the FRG guarantees up to DM 20 million worth of individual transactions through Hermes. Even though Cairo has surprisingly announced that it would pay cash for the reactors from oil revenues, it is likely that, considering a foreign currency cost of more than DM 2 billion per unit, a considerable need for residual financing would remain in effect, at least temporarily.

9273
CSO: 5100/2296

GREECE

NUCLEAR ENERGY DEVELOPMENT STATUS REPORTED

Athens BUSINESS & FINANCE in English No 152, 25 Jul 81 pp 2-4, 6-10

[Text]

The complicated problems that there are in connection with the installation of a nuclear reactor in Greece arise from both the nature of the reactor, and the particular characteristics of Greece. The most important of these problems concern those conditions and requirements necessary to ensure both the economics and the safety of such a plan. But above all what is required is an urgent inquiry into the extent to which a nuclear power station in Greece is necessary. The number of sound arguments that there are against such a plan make the examination of all the other alternative solutions a necessity.

If it is decided that it is essential to launch a programme for the installation of nuclear electric units, (the control of PPC and EBASCO appear to be suspended), then this programme must be carried out in connection with the creation of the appropriate infrastructure in the sector of nuclear technology. The expenses for such a long-term programme will be no more than between 1% and 2% of the total cost of a nuclear installation.

Another factor in nuclear development is the need for special legislation and regulations, particularly for the normal development of the related activities, and the protection of the public and the environment. Further emphasis must also be given to the uranium deposits that exist in Greece, and the intensification of the geophysical researches.

However, the reactions of other countries over recent years to nuclear programmes, give rise to many doubts:

- In the USA, the nuclear programme has been cut by 200 million dollars.
- In Sweden, a referendum was held to decide whether or not to shut down the nuclear reactors in that country.
- Over the last four years, not a single new nuclear energy unit has been put into operation in West Germany.

At this point we should also mention that the cost of an installation in Greece would be 30% higher than in the other developed countries, because of the costs of transportation, employing foreign specialists, etc. Furthermore, in a period of political crisis, it would be very easy to cut off Greece's supply of both fuel (uranium) and necessary spare parts.

All the Western European countries have adopted a polymorphous energy policy, and neither domestic nor industrial consumption is base exclusively on electricity. A significant part of the consumption is in fact of natural gas. In Greece, by comparison, both domestic and industrial energy consumption is based on electricity, which is the most expensive form of energy. A viable energy source for Greece could be lignite, and the geophysical researches into the Greek subsoil should be intensified. From the existing data, it appears that oil deposits will last for another 75 years, but the fact must be remembered that known deposits of the other conventional fuels are about 25 times the size of the oil deposits. A certain amount of caution is therefore necessary in predictions of the sort that the planet earth will be self-sufficient in conventional fuels only for another number of years, and that the only solution is the development of nuclear energy. Past experience has shown that these predictions can often be refuted, and are sometimes made with the sole aim of increasing the profits of some multi-national companies.

Of course, Greece does indeed have an energy problem. But it has been proved that Greece is not lacking in solid fuels. Greece has significant lignite deposits, turf, oil, natural gas, and several areas that could be exploited for geothermal energy.

The breakdown of the energy potential that has covered Greek needs over the last ten years is as follows:
Solid fuels – 20%
Liquid fuels – 75%
Hydroelectric power – 9%
Gases, etc. – 0%

As can be seen from these figures, energy needs are met 78% by imported primary sources, and 22% by domestic ones. It is interesting to note that the corresponding average percentages for the EC are 57% and 43%. It is clear from all this that at the present time there is a huge deficit in the country's balance of payments for energy. The exported exchange amounts to about 30 billion drachmas annually. And it is also important that the energy policy of the government be directed:

a) to the solid fuels. These deposits would appear to be in excess of 5 billion tons, meaning that needs can be met for another 100 years, approximately.
b) hydroelectric power. Although there has been significant development of the exploitation of this form of energy in the post-war period, there are still margins for further exploitation.

Directing the energy policy towards domestic sources may well allow us to postpone the undertaking of a nuclear programme for at least the next two decades, an advantage, as there are serious difficulties to be overcome in both the technology and the economics involved. At the same time, Greece will thus win the time necessary for the development of the appropriate infrastructure for a nuclear exploitation programme, which is, at the moment, non-existent.

Finally, it should also be brought to mind that a) all the fuel deposits on our planet (ie coal, oil, natural gases and uranium) have an energy potential equal to that which the earth receives from the sun in 45 days. b) the problems that are to be faced today in the transformation of solar energy into electrical energy, and the use of hydrogen instead of benzine or oil, are far smaller than those created by nuclear reactors, the problems related to breeder reactors, and insignificant compared to those problems that had to be overcome in order to enable Man to land on the moon. c) According to the German Professor E. Justi, the energy problem would have been solved by now if just 1% of the expenditure that has been given to nuclear energy programmes had been given for the exploitation of solar energy.

Present Agents and Legislation in Greece

1) The Demokritos Centre for Nuclear Research, and the Hellenic Committee for Nuclear Energy.

The Hellenic Committee for Nuclear Energy (HNCE) is an independent public service that until 1978 was directly under the Prime Minister, who, at that time gave the responsibility for its supervision to the Minister of Co-ordination. The Minister of Co-ordination exercises this control through the Scientific Research and Technology Service of his ministry. The operation of this service was initially defined by the Laws 3891/58 and 4115/60, although the Law in force today is Law 451/68, according to which the HCNE initiates, supports, or conducts scientific and technological research into the use of nuclear energy in the various sectors of science, industry, agriculture, and national defence.

In greater detail, the functions of the Committee are

– to follow international developments in new methods of production of nuclear energy.
– to introduce and to supervise the taking of those measures that are necessary for the protection of the public from the effects of nuclear energy.
– to supervise the training of scientists in order to ensure that needs for the application of nuclear energy are met.

– to provide scientific and technological assistance to the public services, and organisations in connection with the use of nuclear energy.

– to co-operate with other organisations for the discovery and exploitation of radioactive ores.

The HCNE is also responsible for the granting of permits to import, install, and operate nuclear reactors in Greece, the granting of permits for the production and use of radioactive materials and sources, and the control and purchase of Greek radioactive ores.

Today, 700 people are employed by the HCNE, of which 170 are scientific personnel. The reactor office has only three nuclear scientists, who are employed in the operation of the experimental reactor at Demokritos (5 thermic MW), while ten more make up the Group for the Regulation and Control of Nuclear Installations.

2) The Public Power Corporation (DEH)

a) Sector for Studies and Contracts.

This sector is concerned with the supervision of studies and other activities related to the future installation and operation of nuclear installations, the education and training of the Greek scientific potential for the manning of the nuclear stations, the initial formation and construction of standards, and the signing of contracts for the acquisition of nuclear fuels.

b) Sector for Nuclear Safety and Regulations.

This sector is concerned with the application of the special legislation, and the general planning of the structure of the security and safety regulations related to the construction and operation of nuclear stations. It also works in co-operation with other similar Greek and foreign organisations.

3) Other agents.

The Geological Studies and Research Institute (IGME) which is under the Ministry of Industry. Its primary aim is to conduct geological and mining research into the Greek subsoil. A part of the activities of this Institute is the search for uranium.

The General Legislative Framework.

The general legislative framework for the nuclear installations in Greece is basically defined by Law 854/71, which provides legislation for the installation and operation of nuclear reactors, and the definition of the security measures. There is also Law 181/71, which defines the security measures for radiation. In addition, the Mining Codix (Law 210/73) in Clause 143 states that only Greek nationals have the right of research and exploitation of "minerals with radioactive substances".

International laws accepted by Greece.

Greece has accepted the Paris Convention on Third Party Liability in the event of a nuclear accident. (1960) It has also accepted the other part of the same convention which was agreed in Brussels in 1963. These have all been legalised through Law 336/69. Greece has also signed the agreement prohibiting testing of nuclear weapons in the earth's atmosphere, space, and in the sea. This was implemented in Greece by Law 4335/63 (Partial Nuclear Test Ban Treaty). Greece has also signed the Non-proliferation of Nuclear Weapons Treaty.

Existing contracts between the Greek state or public organisations, and foreign states, organisations, or companies.

a) Association with the International Atomic Energy Agency.

Greece is a member of IAEA through the Hellenic Nuclear Energy Committee. The IAEA is an international organisation which offers directions on the use of nuclear energy, and particularly concerning security and safety. However, it cannot be said that Greece has as yet fully exploited that technical aid offered by the IAEA, and such aid that Greece has received from the organisation has not been requested in the proper way.

For example, in the period from 1973-1975, research was conducted in the localisation of radioactive deposits in the areas of Macedonia and Thrace by IAEA scientists A. Y. Smith, and A. Armour Brown. This research was conducted within the framework of an IAEA programme in Greece, but until today, the Greek public has not been informed of its findings.

It is interesting to note that the compilation of the results was carried out by the foreign scientists, which means that there was not real co-operation with Greek scientists.

b) Association with the Nuclear Energy Agency of the OECD.

The Nuclear Energy Agency (NEA) has organised a data-bank, which is at the disposal of its members, and concerns electronic computer programmes for the solution of problems concerning reactors. No significant use of this data has as yet been made by Greece.

c) Association with EURATOM (EC)

The role of the EC in connection with nuclear fuels arises from the EURATOM Agreement which was signed in 1957 by the then six Community member-states. Thus they formed the Communaute Europeene de l' Energie Atomique. The three new members of the EC signed the EURATOM Agreement in 1972, and it will be in force for Greece as well. The EURATOM Agreement refers to the nuclear programmes of the member-countries. It has four major research centres – Isra, in Northern Italy; Mole in Belgium; Geel, also in Belgium, and Petern in France.

d) Contract with EBASCO

Greece has signed a contract with the American company EBASCO, to carry out all the preparatory studies for the installation of a nuclear power station in Greece, expected to come into operation between 1990 and 1995.

The lack of organisation in the exploitation of nuclear energy, and dependence on foreign technology.

a) Research into radio-active deposits.

Two agencies are engaged in the research into and discovery of radioactive deposits. These are DEPO of the HCNE, and IGME. The specialised personnel and the equipment are shared by both of these agencies, with the result that there are fairly grave shortages in both, which could be at least partly eased through co-operation.

This, and the lack of co-ordination in the programming of research, create difficulties, and delays in the discovery of radioactive deposits. The HCNE has greater means and experience, while IGME is in a better position to conduct drillings. Quite apart from these, another disadvantage is that the given financing is insufficient for a sophisticated research programme for the Greek subsoil. So possible uranium-bearing areas must remain unexplored for long periods of time, until the specialised personnel and the equipment are released from other areas.

Another disadvantage in this field is that until the present time, known deposits amount to about 2,000 tons – a quantity that does not justify the creation of installations for their exploitation. In the opinion of the Technical Adviser of the HCNE, Mr Taupitz, for the exploitation of deposits to be economical, they must amount to at least 5,000 tons. The 'possible' 20,000 tons are a very optimistic estimate, as this estimate has been based on simple geological observations, not yet tested with through research. To assess the true value of the deposits, it should be remembered that the operation of a reactor of 800-1,000 MW needs at least 5,000 tons of uranium.

The areas that can be considered promising are Marameno Serron of Xanthi, Papadia of S. Florina. However, it is difficult to describe these as exploitable, as various problems have to be solved, such as the increase of the deposits, the enrichment of the deposits, etc.

b) The installation of a nuclear reactor.

According to international experience, before a nuclear reactor can be installed in Greece, two organised agencies are required for the maintenance, study, installation, operation, etc. of the reactor. One of these agencies would be the State, and the other the exploiting company that would undertake to install the reactor. Both agencies must organise the appropriate infrastructure with the specialised personnel and the correspondent laboratory installations. The role of the State Agency in Greece is filled by HNCE, while according to Greek legislation, DEH has the exclusive right of electrical power production through nuclear stations in Greece, and is the appropriate agent for the promotion and development of the nuclear energy programme.

The HCNE's responsibilities in the installation of a nuclear reactor must be the following:

– the formulation of planning criteria, regulations and standards of security which must be followed for the normal operation of the nuclear unit

– ensuring the good quality performance of the equipement. That is, ensuring that the criteria mentioned above are kept, determining the adequate safety level for the complete protection of the population, environment, and personnel of the installations, exercising quality control, and responsibility for authorising evacuation of the area of the installation, and operation of the nuclear unit, as well as for issuing the order for the interruption of the operation of the station in the event of reduced safety conditions.

The infrastructure that exists today for quality assurance is lacking, and for the quality control is non-existent. These require efforts over several years, with financial backing. Examination of the rates at which both the legislation was formed, and the manning of HCNE proceeds, it would appear to be difficult for HCNE to meet the requirements in quality performance, for a unit expected to come into operation in 1990, while from the aspect of quality control it seems impossible.

DEH'S responsibilities must be:

– determination whether or not a nuclear station is a necessity, and supervision at all stages until the construction and operation of the nuclear reactor.

– it must assume full responsibility for the safe planning, installation and exploitation over the HCNE. According to the Paris Convention, is also has third party liability.

From the number of scientists employed in the DEH nuclear office, (less than 20), it would appear that no substantial infrastructure exists at all, so it is obvious that the relevant studies, regulations, etc., would be prepared not by DEH but by EBASCO, and DEH will simply be forced to accept the proposed solutions.

The expansion of nuclear energy.

To get some idea of the rate of development of nuclear technology internationally, it should be remembered that in 1960 there were 22 reactors in 5 countries, with a total power of 1.14 GW, while in 1972, there were 181 reactors in 19 countries, with a total of 80 GW. These figures indicate how rapid development has been. But since the mid-1970s, all the countries have cut back their nuclear programmes. It is generally admitted today that the nuclear industry is still only in its first stages. No one type of reactor has taken over the market; all have their advantages. The situation could hardly be otherwise considering that the average age of installations in the world today is less than seven years.

In 1970, at the initiative of the United Nations Organisation, the Non-Proliferation of Nuclear Weapons Treaty was brought into force. But it is important to remember that many countries did not sign this agreement, including South Africa, Argentina, Brazil, Chile, India, Israel, and Pakistan. As is well-known, some of these countries have already carried out nuclear tests. The increase in the number of reactors is expected to have dangerous results – before the year 2000, over 20 different countries will have nuclear weapons. Who will be in a position to control such expansion? Of what possible use will be the conventions for the limitation of nuclear equipement?

The solution to this problem, obviously, does not lie in the suppression of the development of nuclear energy. The problems is to find a means of adapting its use to cause the least damage in the present, and the most favourable perspectives for the future.

How dangerous are nuclear reactors?

The nature and the extent of the consequences of a nuclear accident are completely different from all the other dangers that Man has faced until the present time.

• Man is unable to feel radioactive radiation.

• The long life of the radioactive isotopes means that the danger continues for almost limitless time.

• In the event of a big accident, the destruction which would take place for the environment and all forms of animal or vegetable life over an area the size of a small country such as Greece, would be catastrophic, and comparable only to the effects of the explosion of a nuclear bomb.

Despite this, many countries have installed, or plan to install at some time in the future, nuclear reactors. How can this expansion of the use of nulcear reactors be explained when it is of certain that they are related to enormous dangers?

The institute for the safety of nuclear installations in West Germany, Institut fur Reaktorsicherheit (IRS), conducted a study which estimated what the results of a serious nuclear accident would be. According to this study, in the event of a major accident, the liberation of radioactive substances would begin 36 minutes after the event. From that time on, the subsequent dispersal of the radioactive material depends on the meterorogical conditions of the time and location. In relatively mild conditions (with a wind speed of 1 metre per second), the radioactivity of 100 kilometres downwind would be 9,200 rem. The fatal dose for Man is 600 rem.

Accepting that the fatal dose is 600 rem, and assuming a density of population of 485 per square kilometre, then casualties will include 30.5 million deaths, and an area of 63,000 square kilometres contaminated for many years. Radioactivity was estimated to be fatal by the study up to a distance of 400 kilometres from the reactor.

Radioactive Waste.

Apart from those dangers already mentioned, another long-term danger for man is posed by radioactive waste. After a single year of operation, a large reactor has produced as much radioactive waste as would be produced by the explosion of 1,000 atomic bombs of the type dropped on Hiroshima. Until now, the suggested storage areas for radioactive waste have been

1. old salt mines
2. concrete containers that are then sunk at sea
3. vitrification
4. sinking in frozen sea areas

None of these has been proved safe, as because of the long life of the isotopes, it is impossible to predict that they will remain contained within these places for thousands of years.

Nuclear Energy--the Economics

Until 1973, in spite of the many technological achievements made in the field, nuclear energy could not compete with oil. The survival of the nuclear industry until then was attributable more to the fact that nuclear energy was more a by-product of the war industry than its main product. Following the 1973 oil crisis, there was a sudden great demand for nuclear units, and as a result there was an increase in the price of the reactors. The various countries accept as the basis of their energy policy a variety in the methods of energy production, so as not to remain dependent on a single kind of fuel, and face the danger of seeing the nation's industry collapse in the event of an embargo.

After the Arab-Israeli war of 1973, Israel admitted that it did in fact possess atomic weapons – that is, weapons were the main products of the Israeli reactors. Other countries were quick to follow Israel's example, the demand for reactors increased once more, and prices went up yet again. Naturally, countries that were constructing reactors had no qualms about having opponent countries for their clients, and the USA did not hesitate to supply Egypt with nuclear units. This was also the case for India and Pakistan.

The widening use of nuclear reactors forced many scientists to reconsider what their responsibilities were on this subject. The press kept the public informed about the consequences of the nuclear energy expansion. Companies were therefore forced to maintain and improve their security measures, as well as safety measures for the protection of the environment. This led to an even higher price for reactors.

However, this initial optimism about the development of nuclear programmes did not last. The various governments and electricity producing enterprises, sensitive to the cost, soon began to revise their nuclear programmes, and many orders for reactors were cancelled.

As is well-known, one of the main advantages of nuclear, over the other energy forms, is the low cost of the fuel. Obviously, economists did not expect the price of uranium to remain stable, but they did expect that it would show a logical increase in price, comparable to the other fuels, except oil. However, the price of uranium in a three-year period, from 1973 to 1976, increased six-fold. This was far beyond the expectations of both the economists and the specialists in this field, such as Westinghouse. Westinghouse, one of the largest reactor-manufacturing companies, signed a contract with its clients, to provide them with uranium for 29 years at an average price of $ 9.50 a pound. Since in 1976 the price had risen to $ 40, Westinghouse found that it had a deficit of 2 billion dollars.

So we see that uranium, like all other economic goods, comes under the laws of supply and demand. However, the situation for uranium is even more difficult, as known deposits are expected to last between 10 and 20 years longer, according to the percentage of the total energy network that will be nuclear, while oil deposits are expected to last another 30 years.

Therefore, even those who assess its worth according to the profit involved, and ignore the human factor, can clearly see that the expansion of nuclear energy is not economical. The reactor fuel is not a raw material, but a high-technology product. The natural uranium, which contains only 0.7% fissionable material, has to be enriched. Units which are able to conduct this enrichment process are to be found only in the USA and the Soviet Union. The reason why there is such a limited number of these units to be found, is the massive investment capital required.

The result of all the above is the likely future increase in the cost of enrichment, because of the insufficient potential of the industry. Quite apart from the enrichment, the reactor fuel must also be specially refined, and although the cost of the processing is expected to remain stable, the scientists of the IAEA give no explanations to really justify this conclusion.

In fact, the cost of reprocessing is expected to increase sharply, because installations of this kind are the most threatening for the environment, and therefore the most unwanted. Even more important, the radioactive waste from this industry must be stored in a way that is more secure than any that have been found so far today. It is estimated that the costs of storage will be the same as those of processing.

For those countries that are at a distance from the reprocessing units, transportation costs and insurance rates must also be added to the total expense, and insurance rates are naturally extremely high. The capital cost of the reactors is far greater than that of the thermal units. The price for a reactor of 1,000 MWe increased from $ 134 per KWe in 1967 to $ 1,200 in 1976. A considerable part of the cost was that necessary for security and the environment, which increased from $ 25 million in 1967 to $ 420 million in 1974 for reactors of 1,000 MWe.

There is a fluctuation in the data given to the public on the cost of electricity. This cost also differs from country to country. According to the French pricing system, the cost of the electrical energy per KWh from the reactors, is half of that produced from oil. However, the latest figures from the USA would indicate that the cost is the same for both, with a difference of only $ 0.005 in favour of nuclear energy.

As a general conclusion, it can be stated that nuclear energy today is in a transition stage, and that a country must be more than brave to decide to attempt to solve its energy problem exclusively through the use of reactors.

Nuclear Energy in Developing Countries

The use of nuclear stations, which many of the developed countries have adopted as a solution for their energy problems, is not attractive for the developing countries, such as Greece, for the following main reasons:

– The advantages of nuclear stations become obvious only when they concern units of production of over 600 MW, but these countries are up against difficulties in introducing units of such power into their systems.

– Because nuclear technology is imported, it is very expensive. Also, in a country which is not able to manufacture between 70 and 80% of the technical equipment needed for a nuclear station, in its own domestic industry, the country becomes completely dependent on outside sources.
– The supply of nuclear fuel is obtainable only from two or three countries in the world, and only after industrial processing of the fuel, which worsens the problem, and increases the dependence.
– Security and safety systems place an extra burden on the cost of installation of a nuclear power station, to an amount that is two or three times greater than an equivalent oil-fired station. During the seven years between 1968 and 1975, the capital cost of a nuclear station increased five-fold.
– The known deposits of uranium in the world will not last longer than 1990. It is generally believed that an abrupt increase in the price of uranium will take place.

'Yellow cake' uranium deposits are estimated to be about 2,000,000 tons. Considering the estimates which were made in 1977 on the rate of installing nuclear reactors in the world, and remembering that a reactor of a power of 1,000 MW requires 200 tons of 'yellow cake' annually, we can draw the conclusion that the thermal reactors will not last later than the year 2000. Any country, therefore, that installs a reactor in the year 1990 (as has been suggested for Greece), will almost immediately come up against supply problems. Uranium prices will be extremely high, and nuclear power will then be as uneconomical as oil.

At the 33rd Conference of the Economic Commission of Europe of the OECD (18.1.1978), it was officially announced that the uranium deposits which are available to the OECD countries at a price of $ 64 - $ 65 a kilo, would be sufficient to supply the reactors to be installed in these countries until the mid-1990s. After 1995, reactors will have to base their operation on uranium deposits whose cost is unknown today, and whose very existence is unsure. Obviously, it is not necessary to have to wait until 1995 for prices to increase; the price today is between $ 80 and $ 85 per kilo.

Breeder reactors.

The so-called breeder reactors have been put forward as a proposed solution to the limited prospects of the thermal reactors. It is not known when they will actually appear on the market, but apart from this, and the many safety problems they present, the major cause for concern in their use is the fact that they are concerned with the increase of plutonium, a raw material that is used in the construction of nuclear weapons. Plutonium is highly toxic – even a millionth of a gram is fatal. It is difficult to accept the fact that this material will be produced, transferred, sold, and processed in thousands of tons in densely inhabited Europe.

But even with the use of non-breeder reactors, there are problems of major concern, that as yet have not been solved:

– there is still no satisfactory method for disposing of radioactive waste.
– the quality of uranium as a dangerous raw material for the manufacture of weapon adds a whole new dimension to the possibilities for the policies of those countries which are in a position to export enriched uranium.
– there is no guarantee that opportunist pricing policies will not be applied, or that uranium-producing countries will keep their prices low when oil-producing countries raise the price of oil.

The total installed electrical power in Greece today is 4,750 MW, with an annual production of 22 billion KWh, and with an expected rate of increase of 6-9% a year. In 1978, 47% of the electricity produced was from lignite, and 18% was from hydroelectric power. According to the Ministry of Industry and Energy, the corresponding percentages for 1988 will be 75% and 11%. According to the Public Power Corporation (DEH), towards the end of the decade, domestic primary energy sources will be used in 88% of electric power production. Also, according to this data, the major problem at the end of the decade will be how to produce the other 12%. Will it really be necessary to meet this need with a nuclear reactor?

Research into other energy forms have been set back 20 years as a result of the single-minded concentration on nuclear energy. Today, of course, a far greater effort is being made, but for Greece it is still not enough. The 2% of Greek needs which the Ministry of Industry and Energy expects solar energy to cover by 1990, is not enough. The geothermal sources in Melos, where there is potential for a station of 10 MW, and in other places, could and should contribute more decisively to the energy supply of these areas.

When discussing the various problems related to nuclear energy, emphasis must be given to the human factor. For Greece to launch a nuclear programme, there must be in the country a sufficient number – both quantitively and qualitatively – of trained personnel in various sectors; engineers, directors, special technicians, security personnel, etc. Unfortunately, the human infrastructure in Greece is insufficient, and neither are there programmes for the creation of the appropriate infrastructure. The easy solution – importing foreign advisers – will keep nuclear technology a 'foreign body' in Greece, and will keep Greece in a situation of technological and therefore political dependence, quite apart from any considerations of cost.

The basic studies for the selection of the site for the installation of the reactor is to be made by the American company EBASCO. The Greek Public Power Corporation will simply choose one of the five sites that EBASCO proposes.

Countries such as England, France and the United States, that have large nuclear programmes under development, employ hundreds of thousands of specialists and scientists in nuclear technology. It would perhaps be better at this stage for Greece to forget her ambitions and purchase only a small reactor of between 60 and 80 MW. In this way, Greece will then have the opportunity to train personnel under conditions far more favourable than they would be with a 600 MW reactor.

To install a reactor of 600 MW would be much more expensive than to install one of 1,200 MW – about 4% more expensive per installed MW. Today, to install a 1,200 MW nuclear station, one would need $ 1.5 million per MW – at conservative estimates – and this figure could easily rise to $ 1.8-2 million per MW, a total amount of $ 1.8 billion.

Table 1: Time development of the nuclearisation percentage in various countries.

	USA	USSR	EEC	SPAIN	SWEDEN	FRANCE	E.GERMANY	W.GERMANY
Year of beginning	1957	1958	1956	1968	1964	1959	1966	1966
first installation	0.07	0.2	0.04	1.1	0.08	0.25	0.6	0.7
1970	1.8	1.0	3.8	0.8	2.6	4.6	0.6	1.[illegible]
1974	6.4	1.7	4.9	4.7	5.1	5.9	3.3	5.0

A reactor of about 800 MW purchased today would cost approximately $ 1.5 billion, an amount to be paid off over 8 years. If, as expected, the programming and installation of reactors were to take place every three or four years, then the costs would become unbearable. The announcement that 5,000 tons of uranium had been found in Macedonia, and the prospects for the discovery of other deposits are positive factors in the consideration of whether or not to install a reactor in Greece, assuming that the deposits are exploitable. But the economics of a future reactor will not be much influenced, as the participation of fuel in the total cost per KWh is limited to between 15% and 25% (depending on the type of reactor). The other 75-85% is made up of capital and operational costs, and remains unaffected by the existence or not of Greek uranium deposits.

Although the search for uranium deposits began twenty years ago, the results have not been those expected, and basically, the lack of infrastructure has not allowed any extensive research until today.

As has already been mentioned, the 5,000 tons of Greek uranium will be sufficient to cover the needs of a reactor of 600 MW for 25 years. Assuming that this station will begin operations in 1990, when, according to the DEH estimations, total electric power production in Greece will be 40,000 GWH and considering that in ideal terms of operation the annual production of the reactor will not exceed 3,600 GWH it can clearly be seen that the contribution of this station will be only 1/11 of Greek needs in electricity, and 1/30 of total Greek energy needs.

The cost per KWh of energy that comes from the nuclear reactors is almost the same as that provided by oil-fired stations. This is even more the case in Greece, as various related studies have proved that the cost will be 15%-20% higher than in the USA. This does not include the cost of the underground installations that would have to be built for security and safety reasons.

Another problem related to the installation of reactors in Greece is the fact that a unit of 1,000 MWe or even 600 MWe even in 1986 will be a relatively large one for the Greek system where the greatest unit today is not more than 300 MWe. Further, as can be seen from Table 1, no country has made the single large step of transforming all at once even 1% of its network to nuclear-based power.

Table 2: Orders for reactors and cancellations. 1970-1980.

	Orders	Cancellations
1970	14	0
1971	21	0
1972	38	6
1973	38	0
1974	4	9
1975	3	10
1976	4	5
1977	2	2
1978	2	11
1979	0	11
1980(Jan - Mar)	0	11

Nuclear energy in the western world is monopolised by the USA. The main US companies are Westinghouse and General Electric, whose future is not sure. Any nuclearisation of the electrical network has as result, the intensification of economical and political dependence on those who monopolise both the fuel and the spare parts. The fuel supply is particularly vulnerable in a period of crisis, on the argument that uranium could be used to make weapons.

Finally, considering the instability of the market for nuclear energy, it does not seem wise for Greece to seek the solution for the country's energy problems in nuclear reactors. It should also be remembered that following the 1973 energy crisis, many other countries at a more advanced stage of technological development than Greece, decided to proceed with a nuclear programme, but reached the conclusion that nuclear energy, at the stage at which it is today, could not provide a solution. Orders for reactors were therefore cancelled, and the reactor-manufacturing companies in the USA sold only 4 reactors in 1975, three in 1976, compared to sales of thirty-five in 1973. (See Table 2).

During the whole decade from 1970 to 1980, 160 nuclear reactors were ordered, and 68 orders were cancelled. 90% of the orders were placed before 1973. Following the accident at Three Mile Island, Pensylvania, there was a radical revision of the nuclear programmes in Europe.

For Greece, alternatives to the use of nuclear units could easily be increased use of hydroelectric stations, and lignite.

Nuclear Energy and Greece--the Other Problems

1. Selecting a site. – Greece is a country subject to seismic activity, and it is extremely difficult – if not impossible – to find an anti-seismic area far from inhabited zones. Furthermore, Greece is strategically placed in a region that could well be the location of military conflict. In any event, the reactor would have to be built beneath the earth, and as a result, its construction costs would be raised 30-40% above the normal.

2. Nuclear waste. – The disposal and storage of nuclear waste is not only a huge international social problem, but also a special problem of any country that decides on the installation of nuclear reactors. Today, all countries that offer technology, or nuclear fuel, do not undertake responsibility for the nuclear waste. G. Harry Stein, in his book "The Third Industrial Revolution" says that for the dumping of nuclear waste in space, or on the moon, (one of the proposed solutions), the tremeadous expense of $ 720 per kilo, or $ 720,000 per ton will be required.

In the New York Times of 13th February 1980, a comment on the government decision for the definite solution of the nuclear waste disposal problem was commented on, under the title "Good sense in nuclear waste". The article said...".... Radioactive waste disposal has been shamefully neglected for most of the nuclear age, now in its fourth decade. Both the government and the nuclear industry long assumed that by the time there was enough waste to be troublesome, some way would have been found of getting rid of it. That has not happened. Used fuel rods are beginning to choke some reactor storage pools. Waste has leaked from aging casks on military reservations. But still there is no agreement on permanent disposal..."

Earlier, also in the New York Times, (November 7th 1978), under the title "Nuclear waste: Our Suicide Path", on the subject of the fatal effects of the dumping of toxic wastes in the 'Love Canal' area of upstate New York, the paper stated: "..... the tragedy of Love Canal can be redeemed only by recognising that we cannot continue on the path of suicidal disregard for the earth, our home. The other path, that of alternative energy development, promises no get-rich-quick solutions to our needs, but is more in keeping with life-centred natural processes which are readily available to all. It is to these 'soft energy' paths that we must turn, if we are to assure the continuation of life on this planet...."

3. Low installed base power. – A reactor of 1,000 MWe, even if it were to begin operations at the end of the 1980s, would cover only 15% of the Greek basic network. This, from the economic aspect, is inexpedient.

4. Nuclear reactors only reinforce electrical power production. – While it is accepted that electrical energy is the most expensive energy form, we continue to suggest as a solution of the energy problem, electric power production. It is interesting to note that while in the EC countries, electrical energy covers 30% of total energy consumption, in Greece, the corresponding percentage is 40%.

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